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Sauget Sewers

VILLAGE OF SAUGET

ST. CLAIR COUNTY, ILLINOIS

FACILITY PLAN ADDENDUM

AND

INFILTRATION-INFLOW ANALYSIS

FEBRUARY 1984

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1.0 SUMMARY AND RECOMMENDATIONS

The basic purpose of this report was to evaluate and analyze the Village of Sauget's sewer system as it relates to infiltration-inflow, the condition of the sewer system including its repair history and past expenditures, the proposed rehabilitation and improvements to the system, and long-term solutions. A general summary and recommendations resulting from this evaluation, including amendments to the original Facility Plan, is summarized briefly in the following statements.

1. Due to the accelerated rate of major sewer breaks and general deterioration of the municipal sewer system in the past couple of years, the infiltration rate has increased dramatically.
2. Flooding conditions during late 1982 and early 1983, accompanied by a rising groundwater table, appears to be the primary factor which caused the accelerated rate of sewer deterioration and the recent increase in infiltration rates. Numerous sinkholes, due to structurally unsafe sewer conditions, currently exist within the municipal sewer system.
3. The average yearly infiltration, during 1983, was determined to be 0.84 MGD which equates to 9% of the total average flow or 6,230 gpd/in. dia./mile of sewer.
4. The peak monthly infiltration, during 1983, was determined to be 2.54 MGD, which equates to 27% of the average daily flow or 18,850 gpd/in. dia./mile of sewer.
5. The current infiltration rate is excessive which warrants cost-effective repair and rehabilitation to the existing sewer system.

6. Based on a straight proportion of yearly operating costs versus gallonage transported and treated per year, the projected annual cost to transport and treat the average yearly infiltration is $481,000 per year equal to a present worth cost of $4,090,000 over a 20 year period.

7. Assuming that the average yearly expenditures for repairs and rehabilitation to the sewer system over the last ten (10) years continues at the same rate, the additional annual cost, not included in the operating expenses above, is projected at an additional $617,000 per year of expenditures.

8. Combining the annual operating cost attributable to infiltration and the past average annual repair/rehabilitation cost, the total annual cost is $1,098,000 per year, equal to a present worth cost of $9,333,000 over a twenty year period.

9. Based on the age of the sewer system and the recent and documented accelerated rate of major sewer repairs, it would be rational to assume that the average annual cost required for emergency repairs and rehabilitation will increase significantly over the next few years. Based on this observation, the above assumption concerning annual repair cost is conservative.

10. Due to the acidic and toxic characteristics of the wastes involved, and the poor conditions of the existing sewer system, the potential for an emergency situation is imminent. Immediate and significant repairs and rehabilitation to the sewer system are necessary, but due to the costs involved, federal and/or state grant assistance is required to make the project economically feasible.

2.0 INTRODUCTION

The Village of Sauget is currently underway with the massive construction project of building and administrating the new regional wastewater treatment facilities, which were originally outlined and recommended in the Facility Plan dated December 1976. The total project cost is projected at $100,000,000 by the time of completion in 1986. The regional treatment facility was required due to more stringent Federal and State effluent requirements.

Within the last few years and subsequent to the completion of the Facility Plan in 1976, the Village-owned sewer system has experienced an accelerated rate of major structural failure warranting emergency repair and rehabilitation conditions. Accompanied by the accelerated rate of failure has been a substantial increase in infiltration rates.

Based on recent investigations, this report will outline the apparent causes of the accelerated rate of structural failure and the associated infiltration increase, the severity of the problem, and a summary of recommendations.

3.0 EXISTING TREATMENT AND COLLECTION SYSTEM

3.1 Wastewater Treatment System

The existing Village of Sauget treatment facility was originally constructed in 1967 providing primary treatment of combined stormwater, sanitary wastewater, and industrial wastewater flows. The 1967 plant basically consisted of a bar screen, a flow measuring flume, and primary settling basins.

In 1976, due to more stringent effluent requirements, the plant was upgraded to include neutralization facilities and stormwater treatment and storage facilities.

The neutralization facilities primarily consisted of a bar screen, raw wastewater pump station, grit removal, lime neutralization, flocculation with polyelectrolyte addition, sedimentation, and mechanical sludge dewatering.

The stormwater treatment and storage facilities basically consist of a storage lagoon and a stormwater primary clarifier. The storage lagoon provides storage of first flush stormwater flows, until the flow through the plant has diminished at which time the stored flows are returned to the plant influent for treatment. Storm flows in excess of the storage lagoon capacity are diverted to a stormwater primary clarifier. Effluent from the excess stormwater clarifier is transported to the plant effluent line and conveyed by gravity for discharge to the river under normal river stages. During high river stages, the effluent from the neutralization and stormwater facilities is diverted to the Corps of Engineers/Monsanto Storm Pump Station and pumped to the river.

Once the regional plant, currently under construction, is completed, the Village-owned plant, described above, will discharge its treated effluent to the regional plant for further treatment.

3.2 Combined Sewer Collection System

The Village of Sauget's sewer collection system was originally constructed in the 1930's with many additions since that time. Since the majority of the sewer system is over 50 years old, major expenditures on repairs have been required especially in the last ten (10) years. Since major portions of the sewer system are currently failing and are structurally unsafe, a major rehabilitation program in the very near future is drastically needed and required. A summary of the past 10 year repair history and an outline of the additional required rehabilitation is included and discussed in later articles of this report.

Due to the corrosive nature of the wastes that the sewers convey, significant precautions are taken in the selection of materials and construction methods. Most of the sewer pipe is constructed of vitrified clay pipe with okum joints sealed with acid resisting cement. In order to improve the structural stability of the collection system, the majority of sewers have been encased or cradled in concrete. A summary of the size, quantity, and average depth is shown on Table 1.

The manholes and interceptor boxes are constructed of brick, lined with acid-resisting mortar or combinations of cast-in-place concrete lined with single or double wall brick, acid-resisting mortar, and in some cases, fiberglass linings. Due to the extreme precaution required to protect the structural integrity of the sewers, manholes, and interceptor boxes, the cost for repairs and construction is much higher than conventional systems.

Due to the general age of the system and a significant rise in the groundwater table accompanied by water table fluctuations, major damage and deterioration of the sewer system has accelerated over the last 10 years. A discussion of the past 10 year repair history is presented in the following report section.

TABLE 1

SEWER COLLECTION SYSTEM SUMMARY

Pipe Diameter (Inches)	Length (L.F.)	Average Depth (Ft.)	Inch-Dia./Mile of Sewer
8	3,765	10	5.70
10	600	8	1.14
12	6,250	13	14.20
15	1,450	12	4.12
18	3,200	11	10.91
21	1,950	11	7.75
24	5,960	11	27.09
30	3,075	15	17.47
36	6,800	17	46.36
TOTAL	33,050		134.74

Average Yearly Infiltration = 6,230 gpd/in.-dia./mile of sewer

Peak Monthly Infiltration = 18,850 gpd/in.-dia./mile of sewer

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3.3 History of Repairs and Improvements

Over the years, the Village of Sauget has incurred substantial costs relating to repairs and improvements to their combined sewer system. In an effort to substantiate these repairs, a summary of the repairs and improvements that were made within the last ten (10) years was developed. Table 2 presents the general description of repairs and their associated costs. As can be seen from Table 2, the total costs to the Village over the last ten (10) years has been in excess of $6,000,000 or an average yearly expenditure for repairs and improvements of over $617,000 per year. Since the recent breaks and structural failures of the sewer system are on an accelerated course, it would be prudent to anticipate a substantial future increase in the total annual cost for repairs and improvements.

3.4 Geographical and Geological Conditions Affecting Infiltration/Inflow

This article will briefly describe and discuss two major considerations: A) A brief presentation of the geographical and geological conditions which exist in the study area and; B) A discussion of the effect that the geological conditions have on infiltration/inflow quantities within the sewer system, in particular the effect on infiltration.

The study area lies within the Mississippi River flood plain known as the American Bottoms. The ground elevations only vary 5 - 10 feet in elevation with an average elevation of approximately 410 feet (MSL), thus the topography is flat and nearly level. The area is generally protected from flooding conditions by a series of levees and stormwater pumping stations.

TABLE 2

EXISTING SEWER SYSTEM
REPAIR & IMPROVEMENT
DESCRIPTION
(1974-1984)

ITEM NO.	DATE	GENERAL DESCRIPTION	TOTAL COST
1	Sept. 1974	Manhole Repairs (Monsanto Ave.)	$ 232,000
2	Aug. 1975	Diversion Box Repairs (Rt. 3, So. Monsanto Ave.)	563,000
3	Aug. 1976	Terminal Railroad Sewer Repairs (Phase I)	331,000
4	Aug. 1977	Emergency Repairs to Interceptor Box (Rt. 3)	17,000
5	Dec. 1977	Sewer Improvements (Falling Springs Ave.)	78,000
6	July 1979	Terminal Railroad Sewer Repairs (Phase II)	2,200,000
7	April 1980	Influent & Effluent Sewer Line @ WWTP (Phase I)	390,000
8	Sept. 1982	Manhole Repairs (Mississippi Ave. - Rt. 3 - Phase I & II)	1,650,000
9	March 1983	Misc. Sewer Repairs	115,000
10	April 1983	Misc. Sewer Repairs	458,000
11	May 1983	WWTP Effluent Box - Damage Evaluation	4,000
12	June 1983	Sewer Repairs (Monsanto Ave.)	132,000
		TOTAL	$6,170,000

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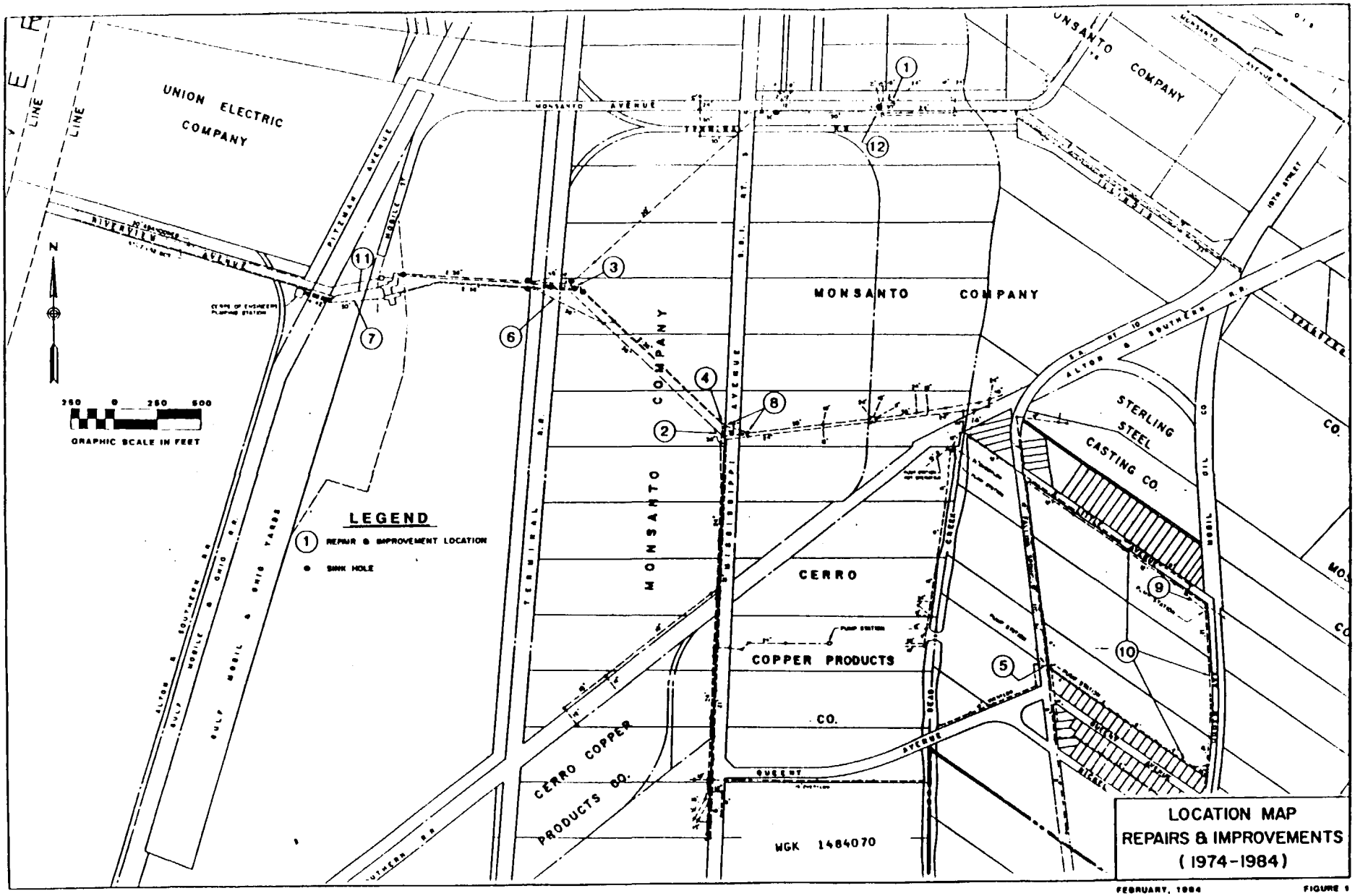

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The soils consist of poorly to well drained sandy, silty and clayey soils overlying granular deposits. The fill soil is underlain by bedrock at depths varying between 100 and 120 feet below the surface. The soils generally fall into two major soil classifications; the Landes-Riley-Cairo Association and the Darwin-Cairo Association. Both soil associations are characterized by "high" groundwater tables.

As shown graphically, later in this report, the groundwater level directly coincides with river stage. During storm events, the flat topography increases the effect on infiltration, due to the subsequent ponding and moderate runoff conditions. Due to the fine grained silt and sand deposits, the groundwater level, and subsequent infiltration, rises in direct proportion to the river stage. This condition directly influences the amount of infiltration entering the sewer system. In addition, the fluctuating groundwater table, over many years, has affected the structural integrity of the sewer system to a point where major sewer breaks and collapses have occurred. Numerous sewer reaches and areas are currently in danger of collapse creating a situation of imminent emergency and hazardous conditions.

During the past year, the unusual high groundwater table has caused numerous sinkholes over sewer collapse areas, which mandated major emergency repair situations. A number of known sinkholes associated with major sewer problems need to be repaired in order to prevent future emergency and hazardous conditions. Due to the silty soil conditions, excessive infiltration tends to cause large sinkholes.

4.0 HYDRAULIC FLOW ANALYSIS

4.1 General

In order to determine the infiltration-inflow contribution to the Village of Sauget sewer system, an in-depth analysis of industrial flows, residential flows, storm flows, and their associated characteristics was performed. As described in subsequent tables and exhibits, the average industrial flows and the residential dry weather flows were combined and utilized as a base flow parameter. All flows recorded at the Village of Sauget treatment plant, that exceeded the base flow or "dry weather flow", were considered as infiltration and/or inflow within the Village owned sewer system. All infiltration within the privately owned industrial sewer systems was included in the recorded industrial flow records, thus the infiltration parameters derived represent the infiltration occuring solely within the Village owned sewer system.

Monsanto Includes Truck I and I

After a review of record data, it was determined to utilize the data recorded during 1983 since the year as a whole produced good representation of high and low periods of rainfall, groundwater, etc. All of the industrial flow to the Village of Sauget's sewer system is monitored on a daily basis as is the recorded data at the municipal treatment facility. In addition, groundwater levels and daily river stages, recorded with the plant data, were analyzed and correlated to the various parameters.

The subsequent sections of the report discuss and analyze three primary considerations: 1) wastewater flow parameters and their fluctuations; 2) infiltration/inflow conditions and their magnitude; and 3) a cost-effective evaluation of the cost to transport and treat infiltration.

4.2 Investigation of Wastewater Flow

Although substantial repairs and additions have been made to the municipal sewer system in previous years, it appears that the severity of the need for major repair work and additions has increased dramatically over the past couple of years. Since the late 1982 flood and the associated high groundwater, major breaks and related sinkholes have occurred on an ongoing basis. The total flows at the municipal treatment plant during 1983 have increased accordingly. Because of these occurrences and the fact that high and low groundwater periods were evident during 1983, the recorded flow data of 1983 was chosen to evaluate the flow conditions.

Table 3 summarizes the average monthly and yearly flow conditions for the plant and base flow parameters. The recorded plant flow includes stormwater excess flows which are stored and treated in the excess flow lagoon and settling basin. The base flow includes the industrial flows plus the residential dry weather flows. The average monthly parameters for the plant flow and the base flow are 9.45 MGD and 8.33 MGD respectively.

A tabulation of the major industrial flows is shown on Table 4. The industrial flow is monitored and recorded on a daily basis and includes the infiltration from the private industrial sewer systems.

River stages, recorded daily at the municipal plant, were evaluated and correlated to the plant annual base flow conditions. A graphical representation of total plant flows versus river stage is shown on Exhibit 2. By examining the graph, it is readily apparent that a direct correlation can be made between high and low plant flows and river stage conditions; as the river stage and its associated groundwater increase, the plant flow increases proportionally. This effect was also correlated to the average monthly infiltration and inflow as shown on the graph.

TABLE 3

AVERAGE FLOW PARAMETERS
(1983)

Month	Plant Flow (MGD) (1)	Base Flow (MGD) (2)
Jan.	8.15	6.84
Feb.	8.86	8.21
March	9.61	8.90
April	10.83	8.68
May	11.02	9.50
June	12.17	11.00
July	10.22	10.30
Aug.	8.65	8.67
Sept.	7.89	7.84
Oct.	8.63	7.55
Nov.	8.57	6.60
Dec.	8.83	5.95
Average Monthly	9.45	8.33
Average Minimum Monthly	7.89	5.95
Average Maximum Monthly	12.17	11.00

(1) Village of Sauget Treatment Works - includes stormwater overflow

(2) Total average industrial flow plus residential dry weather flow

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TABLE 4

MAJOR INDUSTRIAL FLOW PARAMETERS
(1983)

INDUSTRY	AVERAGE DAILY FLOW (MGD)
Amax Zinc Company	.368
Cerro Copper & Brass Company	.613
Clayton Chemical Company	.171
Edwin Cooper, Inc.	.455
Midwest Rubber Reclaiming Company	.515
Monsanto Chemical Company	6.162
TOTAL AVERAGE INDUSTRIAL FLOW	8.284

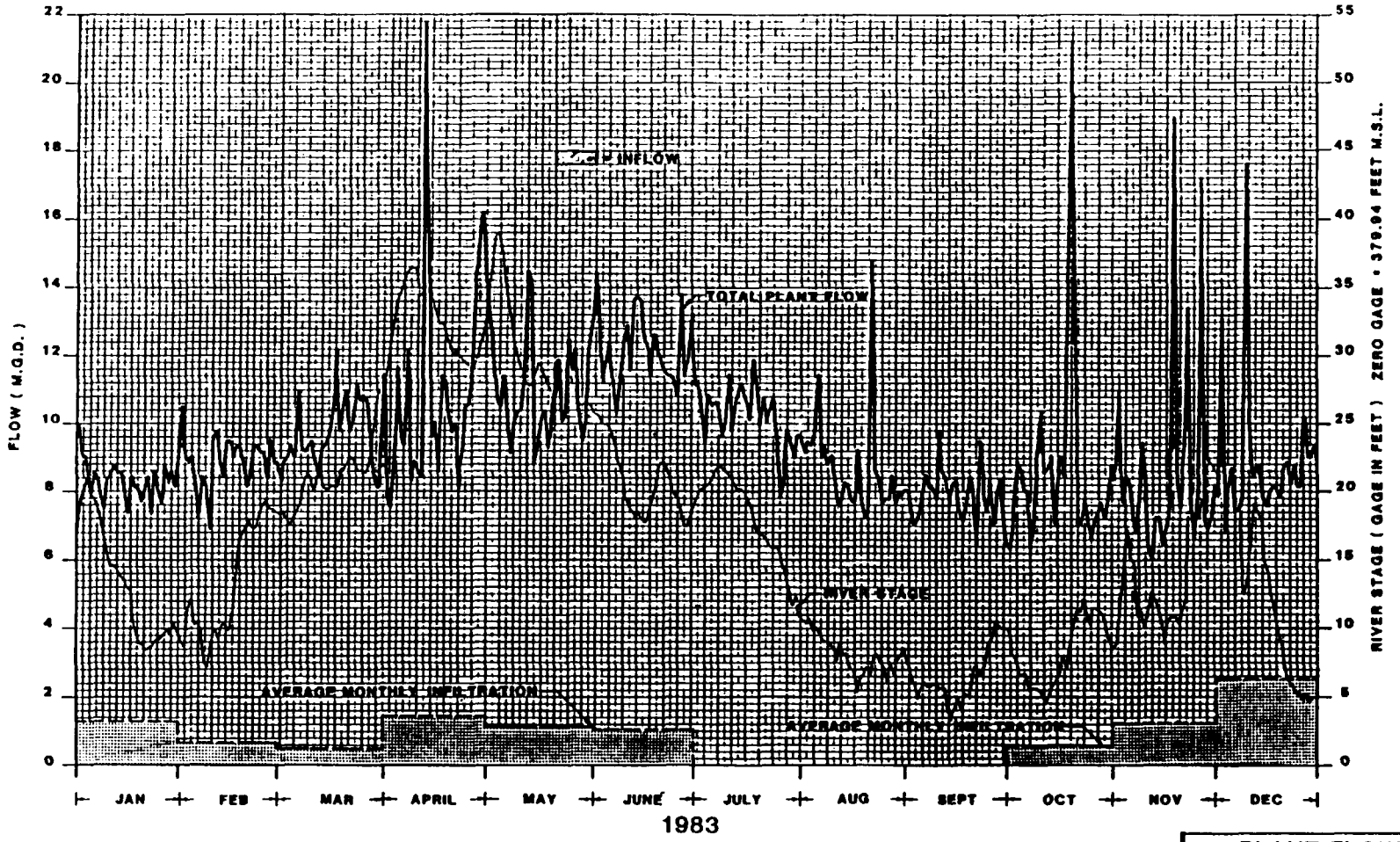
In review of historical plant data, it appears that the total overall wastewater flows have not changed significantly over the past couple of years. Since a substantial decrease in the base flow parameter, industrial flow plus residential dry weather flow, has taken place, it appears that the increase in flow was due to extraneous flow conditions, infiltration and/or inflow.

Due to flooding and high groundwater conditions in the later part of 1982, major breaks and sinkholes developed within the sewer system. Since that time, additional sinkholes and structurally unsafe sewer conditions have continued to develop during the high groundwater periods of 1983. The increasing number of sewer breaks and developing sinkholes appears to be on an accelerated course over the past couple of years. The subsequent analysis and discussion of the current infiltration-inflow conditions demonstrates the severity of the infiltration, its degrading impact on the municipal sewer system, and its potential for creating emergency and hazardous conditions.

4.3 Investigation of Infiltration-Inflow

As previously discussed, the flow data from 1983 demonstrates a significant amount of infiltration. It also appears that the recent sewer breaks and associated sinkholes have significantly contributed to the increase in infiltration quantity. As graphically illustrated on Exhibit 2, infiltration represents a significant component of the total flow, and can be directly correlated to the rise in river stage and groundwater.

As shown on Table 5, the average yearly infiltration was determined to be 0.84 MGD while the peak monthly infiltration was 2.54 MGD. The peak monthly infiltration occurred during December 1983 which also was a high groundwater river stage period. The individual monthly infiltration-inflow parameters are shown on Table 6. The average yearly infiltration equates to 6,230 gpd/in.-dia./mile of sewer, while the peak monthly infiltration represents



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PLANT FLOW vs. RIVER STAGE HYDROGRAPH

FEBRUARY, 1984 FIGURE 2

TABLE 5

FLOW PARAMETER SUMMARY
(1983)

PARAMETER	FLOW (MGD)
Average Plant Flow(1)	9.45
Average Base Flow(2)	8.33
Average Industrial Flow	8.28
Average Yearly Infiltration	0.84
Peak Monthly Infiltration	2.54
Average Inflow	0.28

(1) Village of Sauget Treatment Works; includes stormwater overflow

(2) Total average industrial flow plus residential dry weather flow

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TABLE 6

INFILTRATION/INFLOW PARAMETERS
(1983)

MONTH	INFILTRATION FLOW (MGD)	INFILTRATION % OF TOTAL (1)	INFLOW FLOW (MGD)	INFLOW % OF TOTAL (1)
Jan.	1.24	15.2	.062	0.7
Feb.	0.63	7.1	.021	0.2
March	0.50	5.2	.209	2.1
April	1.44	13.3	.718	6.6
May	1.12	10.2	.402	3.6
June	1.06	8.7	.109	0.9
July	--	--	.005	--
Aug.	--	--	.282	3.3
Sept.	--	--	.044	0.5
Oct.	0.60	6.9	.486	5.6
Nov.	1.28	14.9	.693	8.0
Dec.	2.54	28.7	.342	3.9
AVERAGE	0.84	8.9	0.28	3.0

Average Yearly Infiltration(2) = 6,230 gpd/in.-dia./mile of sewer

Peak Monthly Infiltration(2) = 18,850 gpd/in.-dia./mile of sewer

(1) % of total plant flow

(2) Refer to Table 1

(3) During July, August, and September, base flow was somewhat greater than plant flow. Thus no average infiltration was recordable due to low groundwater conditions.

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18,850 gpd/in.-dia./mile of sewer. These parameters indicate a severe and excessive amount of infiltration since infiltration rates above 3,000 gpd/in.-dia./mile of sewer are generally considered excessive and cost effective to rehabilitate.

The infiltration rate has increased significantly within the past couple of years mainly due to major structural failures and deterioration within the sewer system. The numerous sinkholes and associated sewer failures that occured during 1983, represent documented proof and correlation of the increasing severity of the excessive infiltration conditions.

4.4 Infiltration Cost Evaluation

The annual cost associated with the transport and treatment of the extraneous flows, particularly infiltration, creates a situation where reduction of the infiltration would be cost effective in the long term analysis. After the regional plant is placed in operation, the cost to transport and treat the excessive infiltration existing in the Village of Sauget's sewer system will be magnified. Costs associated with the excessive infiltration will be attributable to the annual operating and maintenance costs for both the regional plant and the Village owned collection and treatment facility.

Based on last year's audit, the operating and maintenance cost for the Village of Sauget's treatment system was $2,300,000 or $0.67/1000 gallons. Assuming a direct proportion, the annual cost associated with treatment of the average yearly infiltration of 0.84 MGD would be approximately $205,000 per year. The projected operating and maintenance cost of the new regional plant is $0.90/1000 gallons, and utilizing a direct proportion as outlined above, the annual cost to treat the excessive infiltration equates to $276,000 per year.

The total annual cost to treat the current average infiltration, after the regional plant is in operation, is $481,000 per year. Assuming this annual cost remains constant over the next twenty years, the present worth capital cost associated with an annual expenditure of $481,000 per year, is estimated to be $4,088,500.

Assuming that the infiltration rate will remain constant over the next 20 years is conservative since the recent accelerated pattern of sewer system failures will only increase the infiltration rate as time goes on. The average annual repair and improvement cost, as stated in Article 3.3 of this report, is $617,000 per year. Assuming the past average repair cost remains constant over the next 20 years, the present worth of these annual repairs is $5,244,500. Combining this with the total operating present worth cost, the total present worth cost which can be related to average infiltration and rehabilitation is $9,333,000.

5.0 RECOMMENDED REPAIRS AND IMPROVEMENTS

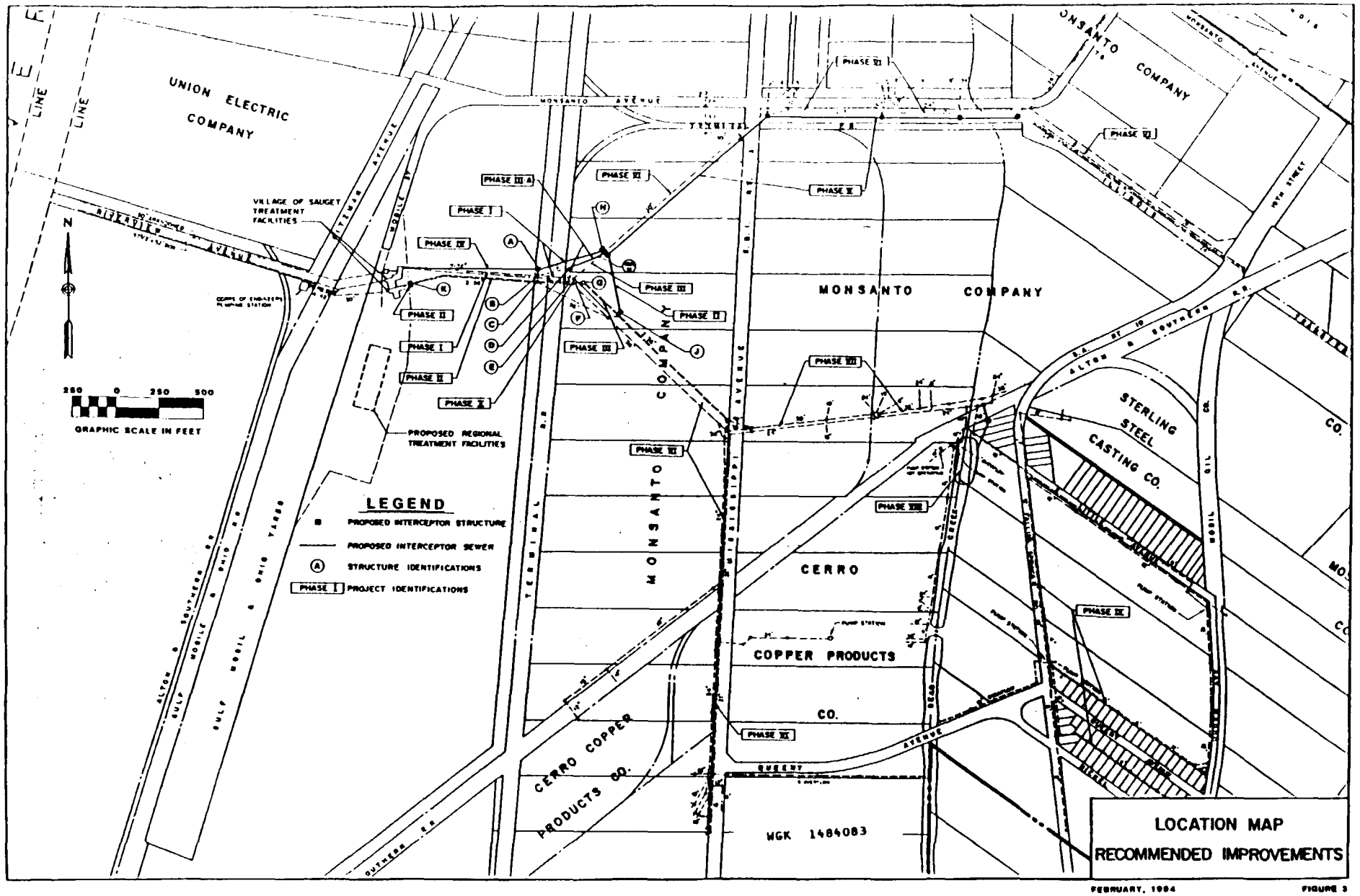
5.1 General

Due to the relative nature and size of the required repairs and improvements, the project has been segmented into phases characterized by specific project identifications. Due to the large flows involved and their continual nature, some of the individual projects require construction of by-pass sewers and/or continual by-pass pumping during construction. In addition, some by-pass lines are needed to safeguard the future integrity of the sewer system if future repairs become necessary. The specific location and letter designation of the projects and points of reference are presented on Figure 3. A preliminary estimate, according to project designation, is presented in tables following this report section.

5.2 Outline of Repairs and Improvements

PHASE I) The existing 36" line, constructed in the 1930's, under the Terminal Railroad tracks (between interceptor box B and E) has been the source of sinkholes and emergency repairs within the past couple of years. Four lines of similar age and condition were abandoned in 1975 due to settlement and structural failure. A preliminary investigation of this line has demonstrated that the line has deteriorated to such a condition that it is structurally unsafe and is beyond repair. Due to the recent sinkholes, emergency repairs to the railroad tracks and their foundation has been required.

Prior to abandoning the old 36" line, a new 42" line is required between new interceptor boxes A and H. The remaining 36" line initiating at interceptor box B and running to the Village's treatment facility is also in need of major repairs but from a preliminary investigation, it appears that



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this line can be rehabilitated by cleaning, televising, and pressure grouting the joints.

In addition to the above, the settlement under the railroad tracks needs to be permanently repaired.

PHASE II) After a preliminary investigation, it appears that in order to perform the needed repairs and rehabilitation under this project designation, a new 42" line will be required between interceptor boxes J and H. It is anticipated that the repairs described below will be extensive and time consuming which precipitates the need for a bypass line during construction. In addition, this line will serve as a relief sewer under high flow conditions and a permanent avenue for flow diversion when additional repairs to associated lines are required in the future.

Once this new line has been installed and the flow diverted, it is recommended that cleaning, televising, grouting, and rehabilitation be performed in the following areas. The two (2) - 36" lines running west from interceptor box C to the treatment facility should be cleaned, televised, and grouted including a new cleanout manhole at the treatment plant. The existing 30" line between interceptor box E and H should also be cleaned, televised, and grouted. This can only be performed once the new lines from interceptor boxes H and A and interceptor boxes H and J are completed. The two (2) - 36" lines from interceptor box J to box F should be cleaned, televised, and grouted. In addition, it appears from visual inspection that substantial repairs to interceptor boxes E, F, and G are required.

PHASE III & IIIA) Due to the past history of repairs to the interceptor sewers running under the Terminal Railroad tracks, major rehabilitation to this area and its associated lines or replacement of individual lines and miscellaneous modifications is required. In order to cost

effectively evaluate this area, two (2) alternatives, Phase III and IIIA, were studied.

Phase III consists of cleaning, televising, and grouting the two (2) - 36" lines from interceptor box J to E, and the 30" line from Manhole H to interceptor box E. In addition, significant repairs to boxes E, F, and G would be required.

Phase IIIA consists of tunneling a new 36" line under the Terminal Railroad tracks and construction of the proposed interceptor box H. Manhole H would be eliminated and repairs to box D would be included. In addition, the existing 36" line from box D to E would be abandoned.

The most cost effective and reliable alternative appears to be Phase IIIA, which constitutes the recommended alternative.

PHASE IV) Due to past abandonment of 36" lines transporting flow to the treatment facility, a new 42" line from interceptor box A and Village-owned treatment facility is required in order to prevent further surcharging and damage to the sewer system. Due to the close proximity of Union Electric property and overhead lines, substantial sheet piling will be required. In addition, this new line will be required while repairs, described above, are taking place.

The past abandonment of the existing lines was mandated by structural failure of the sewer system in recent years and to insure the integrity of the existing railroad system.

PHASE V) The capacity of the existing lines along Monsanto Avenue and leading to existing interceptor box E are not of adequate capacity to transport the combined flows. In addition, these lines are a source of major infiltration and are in need of structural repair. Due to the continual flow nature of these sewers and the inability to bypass the flows to another line, cleaning, televising and grouting of these lines cannot be performed unless a

new parallel line is first constructed. The new line would serve a dual purpose by adding the needed increase in capacity to this area and serving as a bypass line so cleaning, televising, and grouting can be performed in a subsequent phase.

Phase V consists of constructing a new 42" line along Monsanto Avenue and extending to interceptor box H. Also included are a number of interconnects to the existing lines accompanied by new junction structures.

PHASE VI) Based on preliminary investigations and the history of past repairs and problem areas, cleaning, televising, and grouting of various sewers, as shown on Exhibit 3, are required. In addition, repairs and rehabilitation, to the associated manholes and interceptor boxes along this sewer reach will also be required.

PHASE VII) The existing sewer system from Route 3 to the Alton and Southern Railroad does not have adequate hydraulic capacity to transport the existing flows and is in need of significant rehabilitation. Monsanto Chemical Company will be installing their own 42" line in the very near future, which will significantly increase the system hydraulic capacity. Once this is installed, the existing sewers within this area can be upgraded and rehabilitated. The combination of Monsanto's proposed 42" line and the rehabilitation of the existing sewers will enhance the hydraulic capacity and reduce surcharging of the existing lines.

Once Monsanto's waste is removed from this reach of sewer lines, it will be feasible to rehabilitate the existing sewer system in this area by utilizing the "insituform" technique of lining sewers. The insituform process has already been used within the Village's residential area with good success and can be used successfully where caustic wastes are not present. Also included in this project are much needed repairs to many of the existing interceptor boxes and manholes.

PHASE VIII) In an effort to reduce the stormwater entering the sewer system and to eliminate any bypass overflow conditions from the existing pump stations, a stormwater detention basin and associated pump station were previously proposed by report dated May 1983. The project consisted of transforming part of Dead Creek into a stormwater detention basin and collecting the stormwater bypass from the surrounding area in the detention basin until such time that the flows within the sewer system subsided and the retained overflow could be pumped back into the system. The main purpose of this project would be to eliminate the serious basement backup condition that currently exists within the residential area and to reduce the surcharging effect in sewers downstream.

PHASE IX) In order to complete a phased project started some years ago, it is recommended that the sewers serving the residential area between Queeny Avenue and Nickel Street and the residential sewers along Falling Springs Road be rehabilitated using the insituform technique. The sewers in this area have been the source of numerous basement backups during significant flow conditions. It appears that the previously installed insituform has helped to reduce the occurrence of basement backups but continuation of the project is necessary. In addition, the existing 6" sewer lines should be replaced with 8" sewer to conform to current regulations and add needed hydraulic capacity.

PHASE X) As described under previous phases, the construction of new lines and associated structures will enable the Village to abandon the Terminal Railroad box (Structure E) and the associated lines. Due to the severe deterioration of this structure and the associated lines, significant future repairs will be necessary if they are allowed to remain in use. Since other avenues to transport the combined sewer flows are included in prior stages, the

abandonment of this structure and its associated sewer lines is warranted. Phase X basically consists of the necessary requirements to perform the above described abandonment.

TABLE 7

PRELIMINARY COST ESTIMATE

PHASE I

ITEM	COST
Clean, Televise, Pressure Grout - 36" Line	$ 75,000
Repair Boxes B & C & Box A Stub	492,000
Interceptor Box A	226,000
Interceptor Box H	182,000
Dewatering for Box A & H	162,000
Abandonment of 36" Interceptor	51,000
Tunnel 42" Under Tracks	469,000
Bypass Pumping	237,000
Subtotal	$1,894,000
Contingencies	189,000
Total Construction Cost	$2,083,000
Engineering & Construction Inspection	192,000
TOTAL PROJECT COST - PHASE I	$2,275,000

TABLE 8

PRELIMINARY COST ESTIMATE

PHASE II

ITEM	COST
Interceptor Box K	$ 280,000
Clean, Televise, and Grout - 36" Lines	150,000
Interceptor Box J	165,000
Install 42" Line	265,000
Dewatering	275,000
Subtotal	$1,135,000
Contingencies	113,000
Total Construction Cost	$1,248,000
Engineering & Construction Inspection	134,000
TOTAL PROJECT COST - PHASE II	$1,382,000

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TABLE 9

PRELIMINARY COST ESTIMATE

PHASE III

ITEM	COST
Clean, Televise, & Grout 2 - 36" Lines	$ 30,000
Clean, Televise, & Grout 30" Line	16,000
Repair Boxes E and F	276,000
Repair Box G	130,000
Dewatering	188,000
Subtotal	$640,000
Contingencies	64,000
Total Construction Cost	$704,000
Engineering & Construction Inspection	105,000
TOTAL PROJECT COST - PHASE III	$809,000

WGK 1484091

TABLE 10

PRELIMINARY COST ESTIMATE

PHASE III-A

ITEM	COST
Tunnel 36" Line under Tracks	$224,000
Eliminate MH H & Connect to Box H	39,000
Repair Box D	75,000
Abandon 36" Line	5,000
Dewatering	152,000
Subtotal	$495,000
Contingencies	50,000
Total Construction Cost	$545,000
Engineering & Construction Inspection	58,000
TOTAL PROJECT COST - PHASE IIIA	$603,000

WGK 1484092

TABLE 11

PRELIMINARY COST ESTIMATE

PHASE IV

ITEM	COST
Sheet Piling	$ 200,000
42" Line from Box A to WWTP	421,000
Connection at WWTP	98,000
Dewatering	251,000
Remove Fence & Support Overhead Electric	115,000
Reinstall Fence, Backfill & Cleanup	20,000
Subtotal	$1,105,000
Contingencies	110,000
Total Construction Cost	$1,215,000
Engineering & Construction Inspection	100,000
TOTAL PROJECT COST - PHASE IV	$1,315,000

WGK 1484093

TABLE 12

PRELIMINARY COST ESTIMATE

PHASE V

ITEM	COST
42" Line (West of Route 3)	$ 543,000
42" Line (Tunnel under Route 3)	275,000
42" Line (along Monsanto Avenue)	1,238,000
Interceptor Structures	330,000
Interconnect & Repair Existing Manholes (1)	869,000
Dewatering	847,000
Paving Restoration & Cleanup	52,000
Subtotal	$4,154,000
Contingencies	415,000
Total Construction Cost	$4,569,000
Engineering & Construction Inspection	325,000
TOTAL PROJECT COST - PHASE V	$4,894,000

(1) Includes bypass pumping

WGK 1484094

TABLE 13

PRELIMINARY COST ESTIMATE

PHASE VI

ITEM	COST
Repair Existing Manholes	$ 495,000
Clean, Televise, and Grout:	
2725 L.F. - 36"	265,000
2000 L.F. - 30"	162,000
4615 L.F. - 24"	299,000
2000 L.F. - 21"	113,000
2280 L.F. - 18"	111,000
Subtotal	$1,445,000
Contingencies	145,000
Total Construction Cost	$1,590,000
Engineering & Construction Inspection	114,000
TOTAL PROJECT COST - PHASE VI	$1,704,000

WGK 1484095

TABLE 14

PRELIMINARY COST ESTIMATE

PHASE VII

ITEM	COST
Insituform Existing Lines	
700 L.F. - 36"	$ 146,000
750 L.F. - 30"	144,000
1450 L.F. - 24"	216,000
Repair Existing Manholes	726,000
Subtotal	$1,232,000
Contingencies	123,000
Total Construction Cost	$1,355,000
Engineering & Construction Inspection	151,000
TOTAL PROJECT COST - PHASE VII	$1,506,000

WGK 1484096

TABLE 15

PRELIMINARY COST ESTIMATE

PHASE VIII

ITEM	COST
Inlet Structures	$ 73,000
Interceptor Box	20,000
Pumping Station	200,000
Piping and Associated Dewatering	593,000
Retention Pond	805,000
Miscellaneous	55,000
Subtotal	$1,746,000
Contingencies	175,000
Total Construction Cost	$1,921,000
Engineering & Construction Inspection	195,000
TOTAL PROJECT COST - PHASE VIII	$2,116,000

TABLE 16

PRELIMINARY COST ESTIMATE

PHASE IX

ITEM	COST
Insituform:	
2400 L.F. - 8"	$ 198,000
350 L.F. - 10"	31,000
1150 L.F. - 12"	108,000
400 L.F. - 15"	42,000
175 L.F. - 18"	20,000
8" Sewer Pipe	172,000
Repair Existing Manholes	18,000
Subtotal	$ 589,000
Contingencies	59,000
Total Construction Cost	$ 648,000
Engineering & Construction Inspection	60,000
TOTAL PROJECT COST - PHASE IX	$ 708,000

WGK 1484098

TABLE 17

PRELIMINARY COST ESTIMATE

PHASE X

ITEM	COST
Abandon Terminal Railroad Structure and Associated Sewer Lines	$ 86,000
Contingencies	9,000
Total Construction Cost	$ 95,000
Engineering & Construction Inspection	4,000
TOTAL PROJECT COST - PHASE X	$ 99,000

WGK 1484099

6.0 CONCLUSIONS

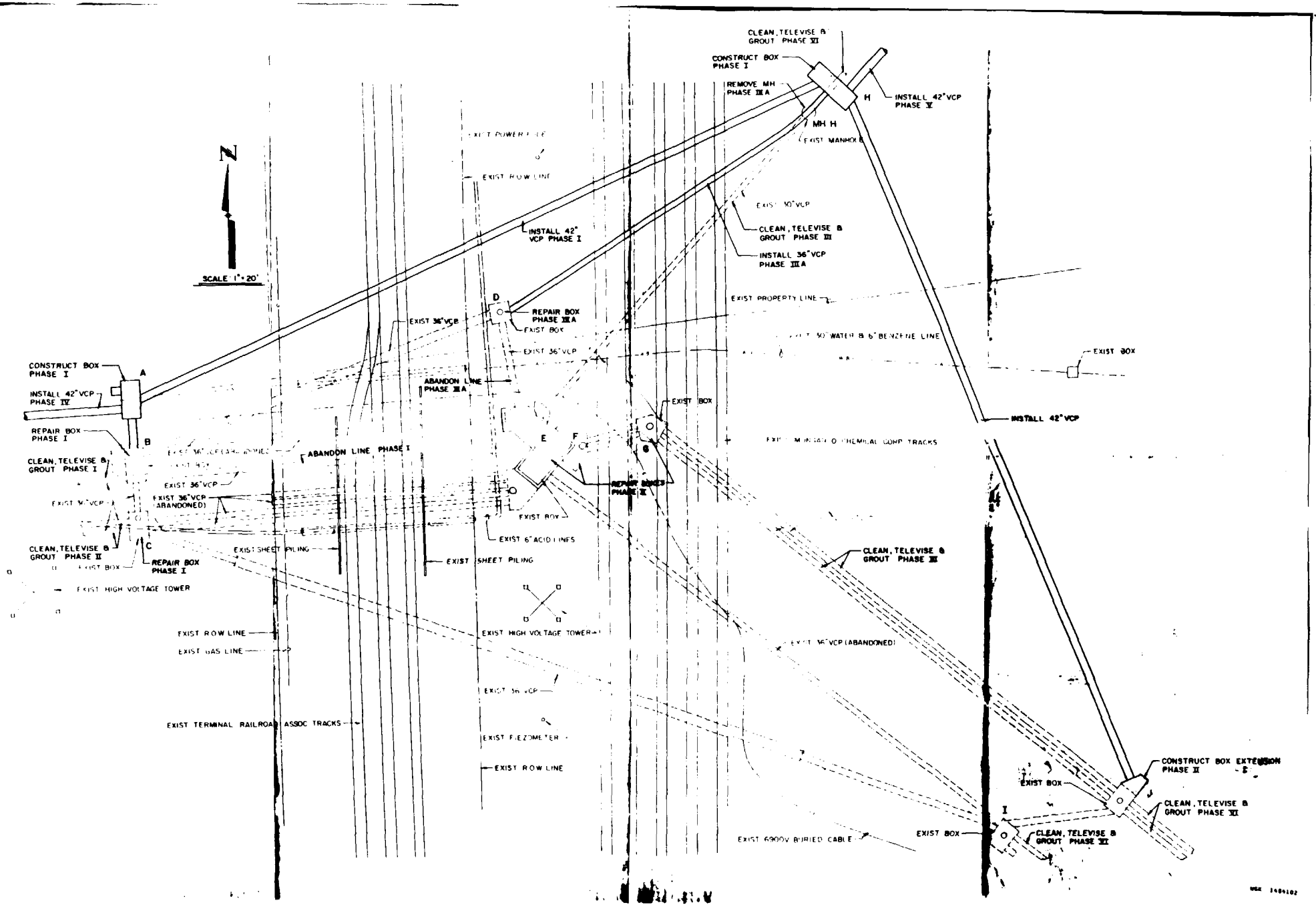
During the past ten (10) years, the Village of Sauget has experienced significant cost expenditures to repair and rehabilitate their 50-year old sewer system. Within the last couple of years, the deterioration to the structural integrity of the sewer system has increased at an accelerated rate causing major sinkholes and emergency repair situations. The flooding conditions and associated high groundwater table in late 1982 and early 1983 appear to be the primary cause for the accelerated rate of failing sewers.

A substantial increase in the infiltration rate has been accompanied by the accelerated rate of emergency repairs and sinkhole conditions. As demonstrated in the report, the average annual infiltration during 1983 was 0.84 MGD or 6,230 gpd/in.-dia./mile of sewer, while the peak monthly infiltration was 2.54 MGD or 18,850 gpd/in.-dia./mile of sewer. The above infiltration rates are exceedingly high and excessive, since as a rule of thumb, infiltration rates greater than 3,000 gpd/in.-dia./mile of sewer are considered to be excessive and generally cost effective to rehabilitate. Including the average yearly cost of repairs and rehabilitation, the total annual operating cost to transport and treat the average annual infiltration was estimated at $1,098,000/year which, over a 20-year period, equates to a present worth cost of $9,333,000.

The three (3) primary reasons that justify the recommended repairs, additions, and rehabilitation to the sewer system are the excessive infiltration; the unusual nature of the wastes that are transported in the sewer system; and the elimination of basement backups in the residential area. Due to the acidic and toxic nature of the waste stream, a major break and/or structural failure of the sewer system would create a very dangerous and hazardous situation. It appears, after investigation of the recent accelerated rate of major sewer failures, that additional and possibly more severe

emergency situations are imminent. Because of this, the recommended repairs and rehabilitation methods should be investigated as soon as possible.

The latest evidence, as outlined in the report, demonstrates that the subject sewer system is experiencing excessive amounts of infiltration and the original Facility Plan should be amended accordingly. Due to the high costs involved in repairing and rehabilitating the sewer system, it appears that the proposed project is not economically feasible unless Federal and/or State grant assistance is available. It is also suggested that due to the unusual circumstances and the emergency nature of the situation, that special considerations are warranted.


N
SCALE 1" = 20'
CLEAN, TELEVISE & GROUT PHASE VI
CONSTRUCT BOX PHASE I
REMOVE MH PHASE III A
INSTALL 42" VCP PHASE V
MH H
EXIST MANHOLE
EXIST POWER LINE
EXIST R.O.W. LINE
INSTALL 42" VCP PHASE I
EXIST 30" VCP
CLEAN, TELEVISE & GROUT PHASE III
INSTALL 36" VCP PHASE III A
EXIST PROPERTY LINE
EXIST 30" WATER & 6" BENZENE LINE
EXIST BOX
CONSTRUCT BOX PHASE I
INSTALL 42" VCP PHASE IV
REPAIR BOX PHASE I
CLEAN, TELEVISE & GROUT PHASE I
EXIST 36" VCP
EXIST 36" VCP (ABANDONED)
ABANDON LINE PHASE III A
ABANDON LINE PHASE I
REPAIR BOX PHASE III A
EXIST BOX
EXIST 36" VCP
EXIST BOX
INSTALL 42" VCP
EXIST MONSANTO CHEMICAL CORP. TRACKS
REPAIR BOX PHASE II
EXIST 6" ACID LINES
CLEAN, TELEVISE & GROUT PHASE II
EXIST BOX
REPAIR BOX PHASE I
EXIST SHEET PILING
EXIST SHEET PILING
CLEAN, TELEVISE & GROUT PHASE III
EXIST HIGH VOLTAGE TOWER
EXIST R.O.W. LINE
EXIST GAS LINE
EXIST HIGH VOLTAGE TOWER
EXIST 36" VCP (ABANDONED)
EXIST 36" VCP
EXIST TERMINAL RAILROAD ASSOC TRACKS
EXIST PIEZOMETER
EXIST R.O.W. LINE
CONSTRUCT BOX EXTENSION PHASE II
EXIST BOX
CLEAN, TELEVISE & GROUT PHASE III
EXIST BOX
EXIST 6900V BURIED CABLE
CLEAN, TELEVISE & GROUT PHASE VII

P H WEIS & ASSOCIATES INC.
ENGINEERS / ARCHITECTS / PLANNERS
PROJECT NO. 7313 - 84 - 2

BID TABULATION
VILLAGE OF SAUGET, ILLINOIS
SEWER REHABILITATION
PHASES I, II & IIIA

DECEMBER 19, 1985

	J. S. Alberici Construction Co., Inc.	Keelev Bros. Contracting Company	McCarthy Brothers Company	Tarlton Corporation	Helmkamp Construction Company	
BID BOND	5%	5%	5%	5%	5%	
BASE BID	$5,998,500.00	$5,665,000.00	$5,724,720.00	$7,152,000.00	$5,330,000.00	
ALTERNATE NO. 1 - 2" Furan Conc. Slab in Lieu of Furan Fiberglass Reinforced Panels	+60,000.00	+67,500.00	+51,634.00	+100,000.00	+60,000.00	
	+30 days	0 days	0 days	+200 days	0 days	
ALTERNATE NO. 2 - Open Excavate in Lieu of Tunnelling	+65,000.00	+225,000.00	+276,345.00	+1,000,000.00	-50,000.00	
	+30 days	+21 days	+30 days	+200 days	+30 days	
ALTERNATE NO. 3 - Furan Conc Bullrings in Lieu of Arched Brick Bullrings	No Change	+57,000.00	-6,800.00	+70,000.00	No Bid	
	0 days	0 days	0 days	+30 days		
ALTERNATE NO. 4 - Oversize Tunnel to Construct Full Furan Tamping Mix Jt. in Tunnel	+525,000.00	+650,000.00	-90,900.00	+500,000.00	No Bid	
	+60 days	+86 days	-15 days	+100 days		
ADDENDA NOTED	1 Thru 4	1 Thru 4	1 Thru 4	1 Thru 4	1 Thru 4	

MGK 1484103